HISTORY OF X-RAY IN DENTISTRY

História dos raios X em Odontologia

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Professor Wilhelm Conrad Roentgen (1845-1923) was working at Wuerzburg University in Germany. Working with a cathode-ray tube in his laboratory, Roentgen observed a fluorescent glow of crystals on a table near his tube. The tube that Roentgen was working with consisted of a glass envelope with positive and negative electrodes encapsulated in it. On November 8th, 1895, he was conducting experiments in his laboratory on the effects of cathode rays. The air in the tube was evacuated, and when a high voltage was applied, the tube produced a fluorescent glow. The new type of ray was being emitted from the tube. Roentgen shielded the tube with heavy black paper, and discovered a green coloured fluorescent light generated by a material located a few feet away from the tube. At the first time he investigated his hand, and he surprised to see his hand bones. It was the beginnings of the new investigate picture form inside, without cutting and open the body.

Roentgen's discovery was to open up an exciting field for doctors. It was now possible to use this new form of radiation in the study of the human body. Broken bones, for example, could now be looked at by using the rays to see straight through flesh. Roentgen decided to call them like an unknown-ray. exact x-rays. A month after his discovery he held a public display featuring the very first x-ray pictures – one's of his wife's hand (Figure 1). The news of this amazing breakthrough caused a major stir in the medical and scientific communities. The news had soon travelled around the world. Doctors soon picked up on the beneficial uses of the x-ray photography and were quick in using them to diagnose health complaints. In Germany the process was known for it's discoverer – Roentgen (Figure 2).

Discovery of new radio-activities

Shortly after the discovery of X-rays, another form of penetrating rays was discovered. In 1896, French scientist **Henri Becquerel** discovered natural radioactivity. Many scientists of the period were working with cathode rays, and other scientists were gathering evidence on the theory that the atom could be subdivided. Some of the new research showed that certain types of atoms disintegrate by themselves. It was **Henri Becquerel** who discovered this phenomenon while investigating the properties of fluorescent minerals. Becquerel was researching the principles of fluorescence, wherein certain minerals glow (fluoresce) when exposed to sunlight. He utilized photographic plates to record this fluorescence. Becquerel continued to test samples of uranium compounds and determined that the source of radiation was the element uranium.

Bacquerel's discovery was, unlike that of the X-rays, virtually unnoticed by laymen and scientists alike. Relatively few scientists were interested in Becquerel's findings. It was not until the discovery of radium by the Curies two years later that interest in radioactivity became widespread.

While working in France at the time of Becquerel's discovery, Polish scientist Marie Curie became very interested in his work. She suspected that a uranium ore known as pitchblende contained other radioactive elements. Marie and her husband, the French scientist Pierre Curie, started looking for these other elements. In 1898, the Curies discovered another radioactive element in pitchblende, and named it *Polonium* in honour of Marie Curie's native homeland. Later that year the Curies discovered another radioactive element which they named *Radium*, or shining element. Both polonium and radium were more radioactive than uranium. Since these discoveries, many other radioactive elements have been discovered or produced.

Roentgen's discovery was a scientific bombshell

1896 on Saturday 28 December Roentgen submitted his manuscript to the secretary of the Physical-Medical Society in Wuerzburg. On Tuesday, 31st December he received the off-prints which he sent together with nine X-rays and New Year greetings to his colleagues by mail. Within the area of Wuerzburg, Roentgen submitted his announcements personally. It was his friend, Professor Franz Exner (1849-1926), the director of the II. Physical-Chemical Institution of the university in Vienna who was one of his very first addressees. Exner and Roentgen had been acquainted since their academic days in Zurich. Both had been assistants to Professor August Kundt. On the occasion of a discussion evening on Saturday, 4th January 1986, Exner showed the X-rays which had been taken by Roentgen to his assistants. One of the present people, Ernst Lecher, at that time professor of physics at the German University in Prague and thereafter in Vienna, in Budapest, informed his father, who was then the editor of Vienna's daily newspaper "The Press"on the performance of Exner that very evening. And in the same night, the first article was written on X-rays and published in „The Press" on Sunday, 5th January, under the headline „A Sensational Discovery". Apart from the physical facts the possible development of these new rays was described in a prophetic manner.

FIGURE 1 - Roengen's presentation on the discovery of X Ray

FIGURE 2 - Roengen's museum

The news spread with the speed of lightening (Figure 3). Shortly afterwards an article was published in the "Frankfurter Zeitung" in "the Electrical Engineer", New York in the "Wuerzburger Anzeiger"in "The Electrician", London in "Lancet" and "British Medical Journal" in "Le Matin", Paris in "Nature", London and in "Times", New York in "Science", New York and in "La Settimana", Florence. Due to the world-wide telegraphic communication of the sensational news, Roentgen received already an inquiry from the American physician Robert Watkins from New York as early as on 8th January requesting him to send some radiographs.

FIGURE 3 - Dr. Heller´s presentation on Rontgen´s rays

Roentgen and the dentistry

Even dentists very quickly recognised the diagnostic advantage for their own special medical field. Especially in dental surgery, significant progress was achieved through the new possibilities of a radiological examination. 14 days later the publication of Roentgen, Dr. Otto Walkhoff in Braunschweig made the first picture of the teeth (Figure 4a,b). Walkhoff asked the physicist, professor Giesel in Braunschweig, to take an X-ray of his back teeth. Small pieces were cut from the commercial plates and subsequently again wrapped light-proof. Walkhoff received the first intraoral X-ray after an exposure time of some 25 minutes. In his report "*it was a true torture, but I felt a great joy at the sight of the results when I become aware of the importance of the Roentgen rays for dentistry.*" In addition to the torture of the long exposure time one also had to accept other inconveniences such as the loss of hair, for instance.

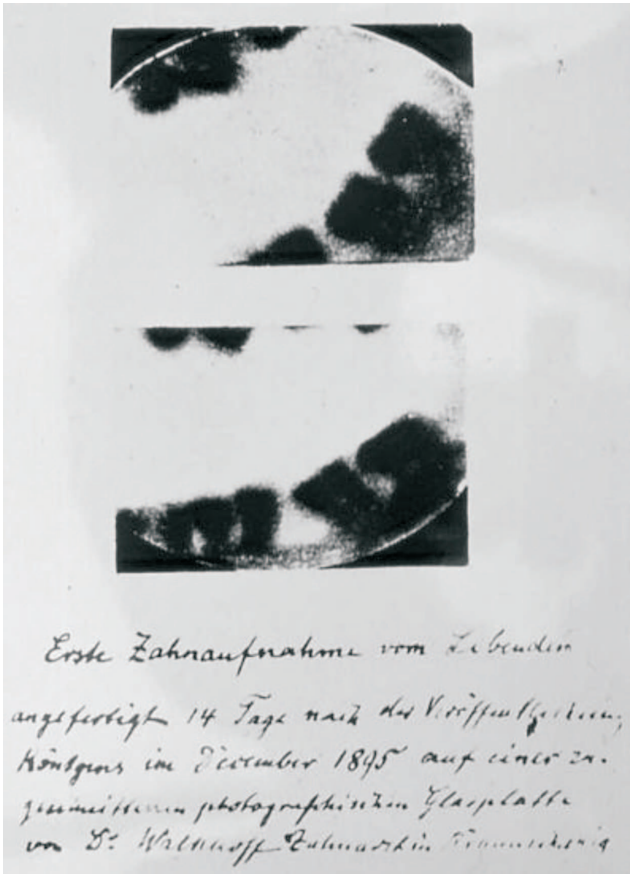

FIGURE 4a - Dr. Walkhoff´s first dental radiograpy

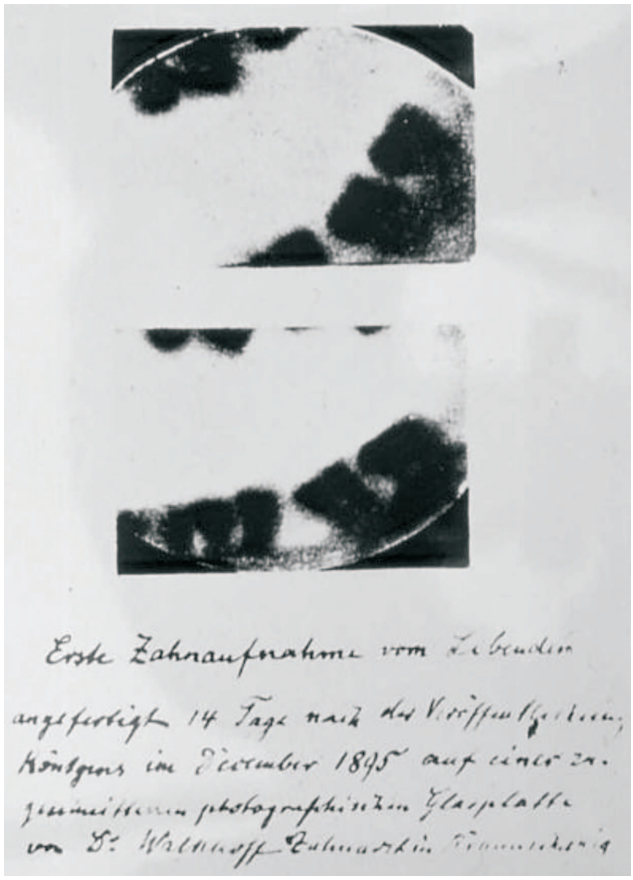

FIGURE 4b - Dr. Otto Walkhoff

Some time later, the physicist, professor Walter Koenig (1859-1936) also published the radiograph of front teeth in upper and lower jaw along with 14 photographs with X-rays. at the Physical Society of Frankfort. It was published in March under the title: "14 Photographien mit Röntgen-Strahlen von Prof W. König" and published by S.A. Bart, Leipzig in 1896.

Koenig emphasises that *'... the X-rays of the teeth are not only able to prove the position and the form of the fillings in the teeth but we are also able to examine parts of the teeth which are sticking into the jaw bones ...'*

Schaeffer and Stuckert and more recently Streller described the Professor König's apparatus responsable for the important reduction in time exposure for 5 minutes. With the tubes of Crookes and Hittorf the cathodic beam spread on a straight line, perpendicular to the plan of the surface of the cathode, and runs into the opposite wall of the tube of glass. The results is a heating of the glass which softens the tube and makes difficult the maintenance of precise pressure.

The new tube of König differs from the precedent one by its anticathode which is made up with a platinum disc located at 45° of the of the convergence point of the cathodic beam (Figure 5). From this emergent point of the electrons, the X-rays spread out in every directions. In 1897, the Franch Professeur Béclère set up first laboratory of radiology in his department of the Tenon Hospital.

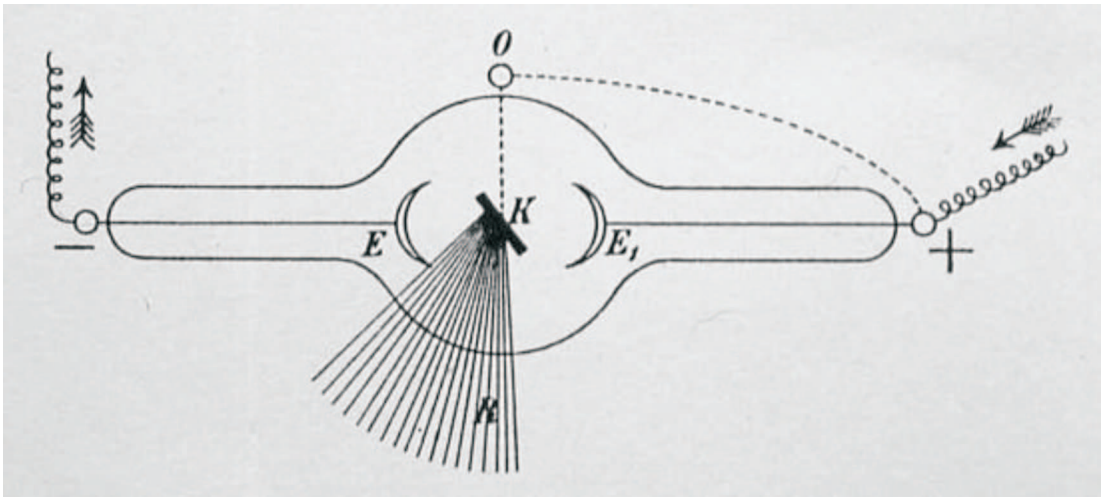

FIGURE 5 - Koning's tube

Louis Richard Chauvin and Félix Allard introduced their own technic and the practical applications X-rays. Frank Harrison in England; William James Morton Junior was the first user of the X-rays, in the United States. He published the first dental skiagraphs in USA the first article in the Dental Cosmos of April 24, 1896 (Figure 6)

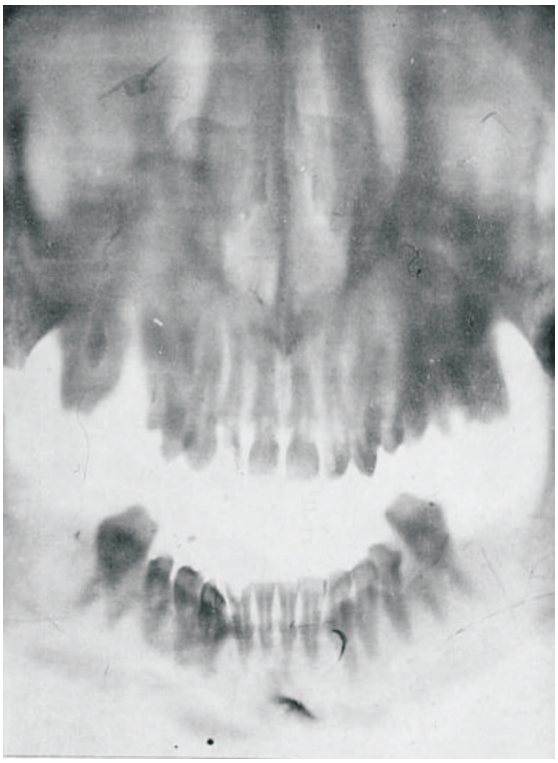

FIGURE 6 - Skiagraphs

Morton´s skiagraphs

Dr. C. Edmund Kells, a dentist practicing in the deep South, became a pioneer in the profession of Dentistry and Medicine with his numerous inventions and publications. Kells was also one of the first dentists to hire a female dental assistant and the one of first to expose a dental radiograph in the United States (Figure 7)

FIGURE 7 - Dr. Kells at his laboratory

Biographic sketches of some of the more prominent early pioneers in oral and maxillofacial radiology are presented, such as those of Walkhoff, Morton, Kells, Rollins, and Raper, along with a discussion of their contributions to the field. The film, put in a small pocket wrapped with a double thickness of black paper and rubber, is set against the dental arcade perpendicular to the teeth to avoid any deformation.For this purpose, he uses a film holder of his invention, maintained month closed to avoid any displacement and not, as you may believe, to avoid a radiodermatitis of the fingers of the operator. William Herbert Rollins as soon as the announcement of the Roentgen's experiment, he begins an intensive work of research on equipments and the use of X-rays in Dentistry (Figure 8, 9 and 10)

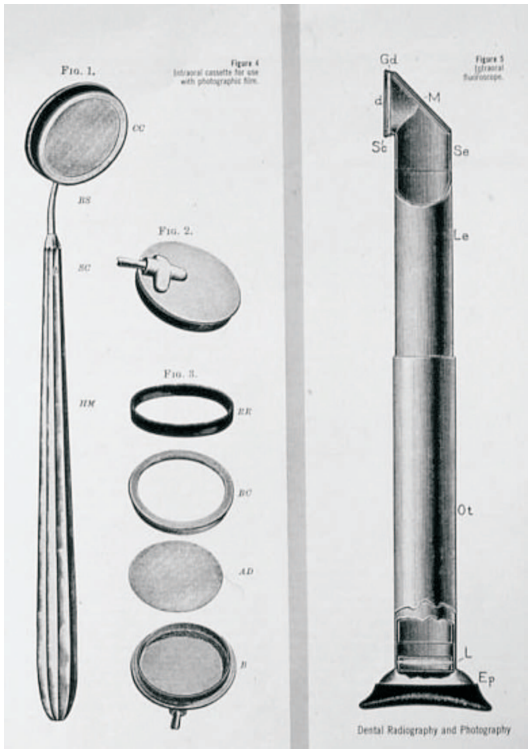

FIGURE 8 - Rollings' cassete and fluoroscope

FIGURE 9 - C.J.B. Stevens radiographic equipment

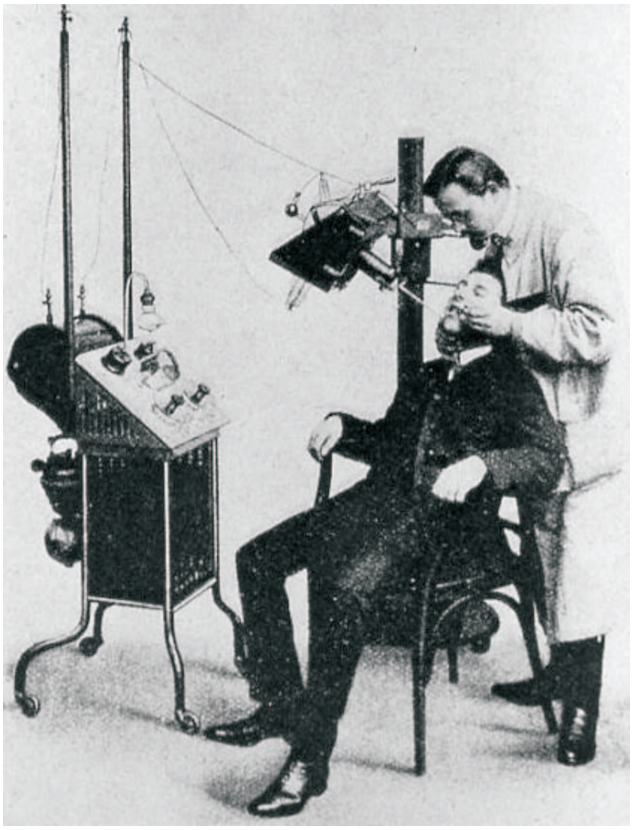

FIGURE 10 - Dr. Blum's X-ray apparatus

Rollins developed a number of pioneering instruments for dentistry an improved on others already in existence. He invented a rheostat with hundreds of steps for the purpose of causing anesthesia by electricity, and made mention of a rheostat that he invented which was continuously variable, depending on the effect of light on the electrical conductivity of selenium. In the consecutive accidents with the use of X-rays, Dr. Rollins affirms that the deleterious agent relates primarily to the Roentgen radiations. X-rays entertainment sessions are daily given at that time in private living rooms in USA and in Europe.

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Received: 07/01/2007
Recebido: 01/07/2007

Accepted: 07/15/2007
Aceito: 15/07/2007